#36

PATENT
Case No. 803 P 019

1/3

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:	)	Examiner: Mehrdad Dastouri
	)	
Hodgson et al.	)	Group Art Unit: 2623
	)	
Serial No. 08/879,322	)	
	)	
Filed: June 20, 1997	)	
	)	
For: MEASUREMENT OF FRUIT PARTICLES	)	

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: the ~~Assistant~~ Commissioner for Patents, Washington, D.C. 20231 on December 12, 2002
(Date of Deposit)
Rachelle Hammerquist
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Rachelle Ham[illegible] 12-12-02
Signature Date

APPELLANTS' BRIEF

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This is an appeal from the Official Office Action (Paper No. 34), mailed October 7, 2002. The Notice of Appeal has been filed concurrently with this Appellants' Brief.

REAL PARTY IN INTEREST

The real party in interest in the present application is Bunge Foods Corporation, who is the assignee of the present application and which assignment has been recorded in the Assignment Branch at Reel 011241, Frame 0381.

RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences.

STATUS OF CLAIMS

Claims 1-10 and 12-20 are currently present in this application. Claims 1, 10 and 12 are the only independent claims.

No claims have been allowed.

All of the claims 1-10 and 12-20 were finally rejected in the last Office Action in this application (Paper No. 34), and appellants hereby appeal from such rejection of all of those last mentioned claims. A copy of the rejected claims in numerical order and from which this appeal has been taken appears in the Appendix to this brief.

STATUS OF AMENDMENTS

No amendments have been made after the last Office Action final rejection (Paper No. 34), mailed October 7, 2002.

SUMMARY OF THE INVENTION

The present invention is directed to the discovery by applicants that conventional, camera computer imaging which was previously employed in the quality inspection of other products, such as contact lenses, semiconductor wafers, electronics and pharmaceuticals, may be employed in the measurement of fruit particles in a starch and/or sugar matrix (Page 2, lines 4-9). Prior to applicants' discovery, the fruit particles in the matrix were washed on a screen to remove the starch and/or sugar matrix so that the fruit retained on the screen could be accurately weighed and analyzed (Page 1, line 15 - page 2, line 2). However, applicants have discovered that camera computer imaging may be employed on such fruit particles without the need to remove the starch and/or sugar matrix (Page 3, lines 4-5). To applicants' knowledge camera computer imaging had never been used in this manner before applicants' discovery.

In the present invention a fruit matrix of fruit particles which are within a matrix selected from a matrix of sugar and/or starch and which is of the kind used in fruit fillings, toppings, dairy products or cooked food products is analyzed. (Page 7, lines 20-21). A sample of this matrix is spread evenly on a sample tray 36 and the sample tray with the sample is placed in a guide frame 40 of a light box cover 38 which is shown in FIGS. 4A and 4B. The light box cover 38 is transparent at least within the tray guide frame 40 (Page 7, lines 7-10) and the light box cover 38 fits over the light box 12 and its translucent screen 14 when both are installed in the opening 32 in the lower portion of the front of cabinet 28 (Page 6, lines 4-9).

The light settings in the light box 12 and the height, position, focus and aperture of camera 20 are then adjusted to

produce an appropriate image (Page 8, lines 15-16) and an image is captured by the camera of the fruit particles while they remain in the fruit and sugar and/or starch matrix. This image is then sent to a computer with software to analyze the image and produce measures of various attributes of the fruit particles without having to remove them from the fruit and sugar and/or starch matrix (Page 8, line 21 - page 9, line 9).

ISSUES

The issues in this appeal are whether the claims on appeal, claims 1-10 and 12-20, are allowable over the rejection stated in the last Office Action Final Rejection (Paper No. 34), mailed October 7, 2002, namely whether:

1. Claims 1, 3-6 and 12 are obvious under 35 U.S.C. §103(a) over QUEISSER et al. (5,818,953) in view of WILKINSON et al. (4,844,937);

2. Claims 2, 7-10, 13, 14, 17 and 18 are obvious under 35 U.S.C. §103(a) over QUEISSER et al., and further in view of WILKINSON et al. and BOLLE et al. (5,546,475);

3. Claims 15 and 19 are obvious under 35 U.S.C. §103(a) over QUEISSER et al., and further in view of WILKINSON et al. and SISTLER et al. (4,975,863);

4. Claims 16 and 20 are obvious under 35 U.S.C. §103(a) over QUEISSER et al., and further in view WILKINSON et al., SISTLER et al. and BOLLE et al.; and

5. Claims 1-20[1] are obvious under 35 U.S.C. §103(a) as obvious over HECK et al. (5,845,002) further in view of WILKINSON et al. and SISTLER et al.

ARGUMENT

1. The Rejection of the Claims on the Prior Art Is Clear Error and Must Be Reversed.

None of the prior art which has been relied upon in the rejection of the claims, and even more specifically the primary prior art QUEISSER et al., HECK et al. and/or WILKINSON et al., discloses the camera computer imaging of fruit particles, and even more significantly, of fruit particles within a sugar and/or starch matrix of the type claimed, either when that art is considered individually or is combined.

QUEISSER et al. discloses nothing more than the camera computer imaging of french fries which are methodically and symmetrically lined up in the shaped grooves 58 in a sample tray during the imaging. In the rejection of the independent claims 1, 10 and 12, the statement is made in the last Office Action that "QUEISSER et al. disclose the sample tray adapted to receive a **fruit matrix**". However, QUEISSER et al. contains absolutely no disclosure or suggestion whatsoever of the analysis of a fruit matrix of fruit particles, that such fruit or fruit particles are in a starch and/or sugar matrix as claimed, or that the grooved sample tray is adapted to receive a fruit matrix. Indeed, the grooved sample tray of QUEISSER et al. would be unacceptable for

[1]Claim 11 was long ago canceled and was not present in the application at the time of the last Official Office Action.

use with the fruit particle matrix of the present invention. **And, QUEISSER et al. does not even contain the word or words "fruit" or "fruit particles" within the four corners of the patent.**

Also of significance the french fries which are imaged in QUEISSER et al. are entirely different in nature, consistency and distribution than that which is imaged in the present claimed invention. In the present claimed invention the material imaged is

> a fruit matrix of fruit particles which are within a matrix selected from the group consisting of a sugar matrix, a starch matrix or a sugar and starch matrix, said fruit matrix being of the kind used in fruit fillings, toppings, dairy products or cooked food products....

See for example claim 1. In this material the fruit particles are random in size, shape and distribution in the sugar and/or starch matrix contrary to the french fries of QUEISSER et al. In QUEISSER et al. the french fries are not in any matrix whatsoever much less a sugar and/or starch matrix, are substantially uniform in size and shape and, during imaging, are arranged in a highly ordered distribution in the grooves 58 of the sample tray 56, as seen in FIGS. 4A and B of QUEISSER et al.

Also of critical significance, is that the french fries in QUEISSER et al. are imaged in an essentially dry condition when in the tray 56. On the contrary, in the present invention the fruit matrix which is imaged of fruit particles in the sugar and/or starch matrix is a matrix which is "of the kind used in fruit fillings, toppings, dairy products or cooked food products". Such matrixes are typically aqueous, gelled or liquid in nature. For

example, as set forth in applicants' reply, mailed August 13, 2002, which preceded the last Office Action:

1. KAUFMAN et al. U.S. Patent No. 4,952,414, Exhibit A[2] (now attached Exhibit 1), is within a food art specifically mentioned in applicants' description, namely the putting up of yogurt food products. Passages in the lower third of column 2 and the upper quarter of column 3 reference the term "matrix" as being an emulsion in which the food pieces are dispersed throughout. The particular matrix of the patent is discussed in some detail in columns 5, 6 and 7.

2. GROSS U.S. Patent No. 4,379,796, Exhibit B[2] (now attached Exhibit 2), uses the term "matrix" in the sense of "a liquid matrix such as sugar containing syrup." See, for example, line 27 of column 6.

3. In the abstract of NOFFSINGER et al., "Liquid chromatographic determination of polydextrose in food matrixes," Journal--Association of Official Analytical Chemists, Vol. 73, No. 1, 1990, Exhibit C[2] (now attached Exhibit 3), reference is made to aqueous extraction of polydextrose from the food matrix, which is in accordance with applicants' use of "matrix".

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[2]In the last Office Action, the Examiner objected to the designation of these exhibits by the letters A-E because other exhibits to Declarations under Rule §1.131 are already of record in the application having letter designations and therefore confusion might exist. Accordingly, these letter exhibit designations have been changed to Exhibits 1-5 respectively and have been attached to this Brief in order to obviate any possible confusion with the earlier declaration exhibits having letter designations.

4. The abstract of European Patent No. 00225154, SANDERSON et al., Exhibit D[2] (now attached Exhibit 4), refers to a gelled food product comprising a matrix, including "fruit or fish gel."

5. Chapter 7 from <u>Processing Fruits: Science and Technology</u>, Volume 1, 1996, SOMOGYI et al., Exhibit F (*sic* "E")[2] (now attached Exhibit 5), while dealing with freezing of fruit, has several references to a fruit and a matrix. For example, the description of the matrix occurs in relation to the aqueous liquid fraction at pages 172, 173, 174 and 175.

Moreover, as stated in the present application, page 1, paragraph 1 of the Background of the Invention, the fruit product to which the imaging of the present invention is to be directed is one which "may pass through piping and pumps". This certainly suggests that the fruit product is aqueous, gelled or liquid.

And finally, if any doubt remains, the inventors themselves have specifically declared on the record in their Supplemental Declaration Under Rule 131, filed February 13, 2001, paragraph 8 that:

> This Supplemental Declaration, our original Declaration, and the above-identified application use terms such as "fruit particles in a matrix", "fruit matrix" and "a fruit matrix containing fruit particles". Such terms typically refer to an aqueous, jelled, liquid matrix.

Such relatively aqueous, gelled or liquid matrix of the present invention presents potential reflectivity problems which could interfere with the optical imaging which takes place in the present invention. Indeed, this is a reason that it was previously

believed that the fruit particles need to be removed from this aqueous, gelled or liquid matrix if they were to be reliably imaged. One skilled in the art would not look to the imagining of the relatively dry non-fluid, non-liquid french fries of QUEISSER et al. to solve the reflectivity problems presented by the aqueous, gelled or liquid matrix of the present invention.

WILKINSON et al. does not cure the critical failures of QUEISSER et al. WILKINSON et al. discloses puffable snack food "half products" formed of fine corn materials which will expand to form a final product by frying or baking to puff into the final product.

As stated by WILKINSON et al. (at col. 3, line 63 - col. 4, line 12), the corn material is one

> which, upon gelatinization under conditions of relatively low shear mixing and temperatures not exceeding about 160°C. (320°F.), advantageously not exceeding 155°C. (311°F.), will form a relatively uniform matrix, at least mainly of starch from the horny endosperm of the corn kernel, which contains relatively few gross voids yet includes a relatively large number of small, closed, capillary-like cells or voids capable of retaining a substantially (*sic*) proportion of the total moisture content of the dough mixture employed. Such corn materials are relatively free of not only corn oil but also starch from the soft endosperm (also known as the floury endosperm) and bran material. We have found that, while the starch from the horny endosperm is beneficial in our method, the starch from the soft endosperm is not only not beneficial to the method but also acts as a diluent and is deleterious.

In WILKINSON et al. a dough containing this corn material is extruded from a die and is then treated over the course of hours to dry the dough to the half product which is to be used for later puffing. This half product is probably even dryer than the french fries of QUEISSER et al. and is certainly not the aqueous, gelled or liquid matrix which is imaged in the present invention. Thus, one skilled in the art would not look to solving the problems presented by a fluid or liquid matrix of the present invention to the dried half product of WILKINSON et al.

Moreover, the matrix of the half-products of WILKINSON et al. is "a relatively uniform matrix" (col. 3, line 66) in contrast to the randomly distributed fruit particles of the claimed invention. Thus, in contrast to the claimed present invention of a sugar and/or starch matrix with <u>fruit particles</u> therein, WILKINSON et al. discloses nothing more than a gelantinized starch matrix with <u>voids</u> therein.

Indeed, the half products of WILKINSON et al. are a single gelantinized starch matrix composition in which not even all of the corn kernel is present in contrast to the discrete fruit particles in a sugar or starch matrix as claimed. These are two completely different physical materials.

The gelantinized starch in WILKINSON et al. is one single entity that has been produced by mixing starch with water, cooking and working to form a gelantinized matrix. Thus, this is one single composition and bears no relationship to the discrete fruit particles in a sugar and/or starch matrix as these are two entirely different materials with one, the fruit, suspended in the other as in the present invention. In WILKINSON et al. there is no fruit or any other material in the starch matrix. In WILKINSON et al. the selected parts of the corn material are the starch matrix and the

photomicrograph is of one single material, i.e. the gelantinized starch. This has no relationship whatsoever to fruit in a distinctly different sugar or starch matrix as in the present invention.

WILKINSON et al. does show cross-sectioned images of the half products made by Examples 1-4 in FIGS. 2-2C. These images do show a starch matrix (without fruit particles) which is extremely dry rather than a fluid or liquid starch matrix as previously discussed. These samples for imaging were

> prepared by excising a small piece from each half product, using a miniature saw, then placing the excised piece in liquid fluorinated hydrocarbon refrigerant at approximately -190°C (-310°F) and allowing the piece to equilibrate thermally, then transferring the piece to liquid nitrogen and fracturing the piece to present a cross-sectional surface, then placing the piece under vacuum to allow the liquid nitrogen to boil off and remaining water ice crystals to be removed by sublimation, then mounting the sample on the scanning electron microscope stub, evaporatively coating the cross-sectional surface with carbon and sputter coating with gold to render the cross-sectional surface electrically conductive.

Column 10, lines 1-14. This procedure is certainly not the photo optic imaging procedure with camera of the present claimed invention, and that which is imaged is not an aqueous, gelled or liquid matrix. Indeed, the subject to be imaged is sublimed to extreme dryness and the imaging is expressly an electron microscope procedure as opposed to a camera optic procedure as claimed. One skilled in the art would not look to the teaching of the WILKINSON

et al. electron microscope procedure of sublimed dry sample for modification of the QUEISSER et al. camera optic procedure. They are entirely different procedures and products from each other.

It is also noted that the electron microscope procedure discussed in WILKINSON et al. and the results of which are shown in FIGS. 2-2C and 3-3C do not have the purpose of "measurement of particles" in the matrix much less of fruit particles as in the present claimed invention. The electron micrographs in FIGS. 2-2C and 3-3C of WILKINSON et al. are simply presented for the purpose of showing the differences between the gelantinized starch half-products of the Examples 1-4 of WILKINSON et al. (col. 10, line 24 - col. 11, line 36). These slides do not measure fruit particle size and are not performed in WILKINSON et al. as an ongoing measurement technique during production as in the present invention.

Moreover, WILKINSON et al. contains no disclosure whatsoever of a sample tray for anything and the Examiner admits that QUEISSER et al. does not disclose the sample tray, as claimed, which receives a fruit matrix. Thus, even when QUEISSER et al. has been modified by the teachings of WILKINSON et al., apparatus still does not result which has such claimed sample tray.

Thus, in summary neither QUEISSER et al. nor WILKINSON et al. measures fruit particles as in the present claimed invention. QUEISSER et al. measures the color of french fries and the electron microscope images of WILKINSON et al. show the distribution of voids in a dry gelantinized starch matrix.

HECK et al. discloses camera computer imaging of <u>whole</u> single items of citrus fruit by measuring the fruit skins. HECK et al. contains no disclosure or suggestion of the analysis of food <u>particles</u> or of any food product which is in a matrix, much less the sugar and/or starch matrix of the claimed invention, or of any

foods which are random in distribution in such matrix, or any foods which are in an aqueous, gelled or liquid matrix.

In conclusion, even when the disclosures of QUEISSER et al. , WILKINSON et al. and HECK et al. are combined, there is no disclosure or suggestion whatsoever of camera computer imaging of any food product which is in a matrix "of the kind used in fruit fillings, toppings, dairy products or cooked food products", i.e. in aqueous, gelled or liquid conditions, or that such imaging may or could be employed for that purpose. All of the materials imaged in the prior art which has been relied upon to reject the claims are dry, and none are fruit particles in a sugar and/or starch matrix. And, none of the remaining secondary references supply these critical failures of disclosure or teaching.

2. **QUEISSER et al. Has Been Overcome by the §1.131 Declaration**.

The original Declaration Under Rule 131, filed May 23, 2000, and the Supplemental Declaration Under Rule 131, filed February 13, 2001, clearly overcome QUEISSER et al. as prior art and, therefore, obviate all of the rejections based upon QUEISSER et al. as prior art.

The Examiner has taken the position that the date of Exhibit F to the original Declaration is critical to establishing reduction to practice of the invention. More specifically, the Examiner states that, because Exhibit F is dated after the filing date of QUEISSER et al., applicants have failed to establish reduction to practice prior to the filing date of that patent.

Applicants respectfully point out that Exhibits A through E of the original Declaration, together with the averments in the Declarations, establish a reduction to practice of a "mock up" of the claimed invention before the QUEISSER et al. filing date.

Exhibit F was provided by way of a confirmation of this reduction to practice. Exhibit F additionally shows all of the components of the earlier mock-up. The difference is that Exhibit F shows a cabinet having hinged doors on the front of the cabinet, rather than a more rudimentary cabinet of the mock up. Hinged doors are not an element of the claims.

Applicants refer especially to paragraph 9 of the original Declaration which notes that Exhibit E reports successful testing of the claimed computer imaging method, using the mock-up apparatus. In addition, paragraph 10 of the original Declaration provides specifics of the mock-up test equipment used to accomplish this successful testing. That paragraph details the features which had been reduced to practice by the time of Exhibit E, which was prior to the effective filing date of QUEISSER et al. And, paragraph 3 of the original Declaration avers that all of these activities were made and completed in the United States of America.

The Examiner has also taken the position that contradictory statements appear in paragraphs 3 and 4 of the original Declaration regarding the date of Exhibit F. Applicants disagree that paragraphs 3 and 4 of the original Declaration are contradictory. The fact that Exhibit F is not dated prior to April 17, 1996 is not contradictory to the statement that the invention was made and completed and actually reduced to practice prior to that date. Although the Exhibit F is dated after April 17, 1996, Exhibit F was submitted only to confirm the structure of the apparatus of the previous reduction to practice as previously stated. As stated in paragraph 11 of the original Declaration, this shows the apparatus of the mock-up cabinet which was reduced to practice prior to April 17, 1996, but in respect of which no sketch could be located. Exhibit F is used to illustrate the components of the mock-up.

Applicants have also submitted the Supplemental Declaration to which a further document was attached as Exhibit G. As declared in paragraph 7 of the Supplemental Declaration, Exhibit G had not been located at the time of the original Declaration. Exhibit G was submitted to confirm that the previously noted mock-up clearly was in existence and was tested prior to April 17, 1996--the filing date of QUEISSER et al. More specifically, Exhibit G is a "Friday Report" which evidences that the claimed invention was reduced to practice by applicants' demonstration of its ability to carry out the claimed invention.

The Supplemental Declaration confirms that the previous Declaration was not contradictory. The Supplemental Declaration confirms that the mock-up apparatus of the claimed invention which carried out the method of the claimed invention was reduced to practice, tested and demonstrated before April 17, 1996, without regard to whether the more formal apparatus of Exhibit F was reduced to practice prior to April 17, 1996.

Exhibits A through E and G are supporting statements, prepared prior to April 17, 1996, which are verbal disclosures of the invention. Applicants respectfully refer to MPEP Section 715.07, from which it is clear that sketches or drawings are not required evidence. In this respect, Exhibit F is superfluous. It is submitted merely as confirmation of the components of the claimed invention. This is consistent with the recollections of the declarants, as confirmed by Exhibit G which establishes (by a document dated prior to April 17, 1996) the reduction to practice and demonstration of the invention before that date.

Accordingly, applicants submit that the original and the supplemental Declarations are fully adequate to prove actual reduction to practice in the United States prior to the effective filing date of the QUEISSER et al. patent.

Applicants also refer to the provisions of the MPEP in connection with Rule 131. Section 715.07 of the MPEP notes that, when reviewing a Rule 131 Declaration, the Office must consider all of the evidence presented in its entirety. Thus, the Office must consider fully paragraphs 9 and 10 of the original Declaration and Exhibits A through E and not merely the later-dated Exhibit F which was provided as a confirmation of the structure found in the mock-up for which applicants could find no currently existing drawing or photograph. It will be appreciated from the original Declaration itself that Exhibit F illustrates the important features of the invention which were in existence and tested before the date of Exhibit F, with the exception of the cabinet being hinged.

While this MPEP Section 715.07 goes on to observe that proof of actual reduction to practice does not require a showing that the apparatus actually existed and worked for its intended purpose prior to the filing date of the cited reference, applicants original and supplemental Declarations do in fact establish such actual existence and workability (in as much as successful tests were carried out before the effective filing date of QUEISSER et al.).

Finally, the penultimate paragraph of MPEP Section 715.07 points out that the averments made in a Rule 131 Declaration do not require corroboration.

For the above reasons it is applicants' position that the previously submitted original and supplemental Rule 131 Declarations, their exhibits and the averments of applicants adequately establish reduction to practice of the claimed invention prior to the effective date of QUEISSER et al. Accordingly, all of the rejections of claims 1-10 and 12-20 on QUEISSER et al. should be reversed.

CONCLUSIONS

For the above reasons, it is respectfully submitted that the rejection of all of the claims here on appeal, claims 1-10 and 12-20, of the present application, must be reversed.

Respectfully submitted,

Date: December 11, 2002

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APPENDIX - THE APPEALED CLAIMS

1. Apparatus for the measurement of fruit particles in a matrix without removing the fruit particles from this matrix, comprising:

a substantially opaque cabinet;

a sample tray adapted to receive a fruit matrix of fruit particles which are within a matrix selected from the group consisting of a sugar matrix, a starch matrix or a sugar and starch matrix, said fruit matrix being of the kind used in fruit fillings, toppings, dairy products or cooked food products;

a camera in the upper portion of said cabinet for taking an image of the fruit particles while they remain within the fruit matrix;

a light source in said cabinet; and

a computer with image analyzing software which analyzes said image of the fruit particles in order to measure the fruit particles without having removed them from the fruit matrix.

2. The apparatus of claim 1 wherein said light source comprises a light box in the lower portion of said cabinet.

3. The apparatus of claim 1 wherein said light source comprises an incident light source within said cabinet.

4. The apparatus of claim 1 wherein the light source comprises switches for adjusting the intensity of the light.

5. The apparatus of claim 1 wherein the light source comprises multiple, independently-adjustable, light-producing sources.

6. The apparatus of claim 1 wherein the inside of the cabinet is non-reflecting.

7. The apparatus of claim 1 wherein said sample tray comprises a light-transmitting bottom.

8. The apparatus of claim 2 wherein said apparatus further comprises a light box cover.

9. The apparatus of claim 8 wherein said apparatus further comprises a sample tray guide.

10. Apparatus for the measurement of fruit particles in a matrix without removing the fruit particles from this matrix, comprising:

a substantially opaque cabinet with a non-reflecting inside surface;

a sample tray with a light-transmitting bottom, said sample tray adapted to receive a fruit matrix of fruit particles which are within a matrix selected from the group consisting of a sugar matrix, a starch matrix or a sugar and starch matrix, said fruit matrix being of the kind used in fruit fillings, toppings, dairy products or cooked food products;

a camera in the upper portion of said cabinet for taking an image of the fruit particles while they remain within the fruit matrix;

a light box with light intensity adjusting switches;

an incident light source; and

a computer with image analyzing software which analyzes said image of the fruit particles in order to measure the fruit particles without having removed them from the fruit matrix.

12. A process for the measurement of fruit particles in a matrix without removing the fruit particles from this matrix comprising:

placing in a sample tray a fruit matrix, said fruit matrix being fruit particles which are within a matrix selected from the group consisting of a sugar matrix, a starch matrix or a sugar and starch matrix, said fruit matrix being of the kind used in fruit fillings, toppings, dairy products or cooked food products;

illuminating said fruit matrix so that an image may be obtained in which the fruit particles are distinguishable from the background;

capturing a computer-readable image of at least a portion of said illuminated fruit matrix; and

using a computer and an image analyzing software program to analyze said image and obtain information concerning said fruit particles without removing the fruit particles from the fruit matrix.

13. The process of claim 12 wherein said illuminating of the fruit particles in a matrix is from below the sample tray, and said illuminating is therethough in obtaining said image.

14. The process of claim 13 wherein said illuminating is from below only.

15. The process of claim 12 wherein the placing occurs spatially between the illuminating location and the capturing location.

16. The process of claim 15 wherein the illuminating has no source which is between the sample tray and the capturing location.

17. The apparatus of claim 1 wherein the light source illuminates the sample tray from below.

18. The apparatus of claim 17 wherein said sample tray is illuminated only from below by said light source.

19. The apparatus of claim 1 wherein said sample tray is between said light source and said camera.

20. The apparatus of claim 19 wherein said light source has no source of light which is between the sample tray and the camera.

Citations from CAB INTERNATIONAL: CBO

1. Liquid chromatographic determination of polydextrose in food matrixes.
CAB 91-01 910301671 NDN- 072-0095-2315-5

Noffsinger, J. B.; Emery, M.; Hoch, D. J.; Dokladalova, J.

JOURNAL NAME- Journal - Association of Official Analytical Chemists
VOL. 73
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1990
PP. 51-53
DOCUMENT TYPE- NP
AUTHOR AFFILIATION- Pfizer Inc., Quality Control Division, Groton, CT 06340, USA.
SUPPLEMENTARY NOTE(S)- 10 ref.
SUBFILE- Sugar Industry Abstracts. (1C Vol. 053 Abs. No. 00457)
SUBFILE CODE- 1C
LANGUAGE- English

A liquid chromatographic method for the determination of polydextrose, a water-soluble low-calorie bulking agent, in food matrixes is described. It involves (a) aqueous extraction of the polydextrose from the food matrix (b) separation on an Aminex HPX-87C carbohydrate column, with 0.005M CaSO4.2H2O as mobile phase (c) refractive index detection for quantitation; comparison with a blank matrix is necessary. Polydextrose recoveries from biscuits, cakes, fruit spreads and chocolate toppings ranged from 91.5 to 100.9%; in 5 replicate analyses, the CV ranged from 0.7 to 4.3%. The method had good precision and selectivity, unlike the modified phenol-H2SO4 method, which was previously used for polydextrose determination in food matrixes.

DESCRIPTOR(S)- analysis; Bulking agents; determination; Foods; liquid chromatography; Polydextrose; Polysaccharides
SECTION HEADING CODE- 1C561000
SECTION HEADING- ANALYSIS AND CONTROL. CHEMICAL ANALYSIS
SECONDARY SECTION HEADING CODE(S)- 1C543000
SECONDARY SECTION HEADING(S)- LIQUID SUGAR AND NUTRITIVE SWEETENERS. OTHER SACCHARIDE SWEETENERS .

Citations from European Patent Granted: EPB

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EXHIBIT
8 3

2. Low-acetyl gellan gum blends.
EPB 95-19 0225154 NDN- 069-0313-9531-6

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PATENT ASSIGNEE(S)- MERCK & CO. INC. (200479) 126, East Lincoln Avenue P.O. Box 2000 Rahway New Jersey 07065-0900 US **DESG. COUNTRIES-** BE; CH: DE; FR: GB; IT; LI; LU; NL; SE
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PATENT APPLICATION NUMBER- 86309183
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ATTORNEY, AGENT, OR FIRM- Cole. William Gwyn et al. (29438). European Patent Department Merck & Co.. Inc. Terlings Park Eastwick Road, Harlow Essex CM20 2QR, GB
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PUBLICATION- 1987-06-10. A2, Published application without search report; 1988-06-08. A3. EPO publication date of search report: 1995-05-10. B1, Publication of granted patent
FILING LANGUAGE- English
PROCEDURE LANGUAGE- English
LANGUAGE- English

EXEMPLARY CLAIMS- A blend of gellan having a level of acetylation of 0.3-0% by weight. xanthan and galactomannan of the ratios by weight:
An aqueous gel comprising 0.1 to 1.5% by weight of a blend as claimed in claim 1.
A gelled good product comprising a matrix in which one or more food ingredients are dispersed. the food ingredients being one or more of vegetable, fruit , meat, fish, sugar, milk, and mixtures thereof. the matrix comprising 0.1 to 1.5% based on total product weight, of a blend as claimed in claim 1.
A gelled food product of claim 3 that is a restructured meat; a confectionary jelly; a jam ; a low calorie jam or jelly; a gelled milk dessert; a water-based dessert; an aspic; a pie filling ; a vegetable, (ie.) fruit or fish gel; a syrup; or a topping .

DESIGNATED COUNTRY(S)- BE; CH; DE: FR; GB; IT: LI: LU: NL: SE .

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PROCESSING FRUITS: SCIENCE AND TECHNOLOGY

VOLUME 1

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Pref

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Fruit Freezing

DAVID S. REID[1]

INTRODUCTION

Most fruits have limited harvest periods. In order to have extended availability, some form of storage and preservation is needed. A variety of preservation systems exist, each of which results in an extended shelf life. Freezing provides a significantly extended shelf life and has been successfully employed for the long-term preservation of many fruits. In this chapter, I will discuss the application of freezing preservation to fruits. In order to do so, it is necessary to first discuss the freezing preservation process briefly and to consider the special problems of preservation that are presented by fruits.

THE FREEZING PROCESS

Freezing involves the use of low temperatures. In general, reactions take place at slower rates as temperature is reduced. One of the more common temperature dependences of rate is expressed by the Arrhenius equation:

$$\log K = \text{const} - E^A/RT$$

where K is the reaction rate, E^A is the activation energy, R is the gas constant, and T is the absolute temperature. Based on this equation, the reduction in rate can be quantified through the activation energy. All other things being equal, therefore, storage at a low temperature would give an

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extended storage life, and the lower the temperature the better. All other things are not equal, however. The Arrhenius expression describes the temperature dependence of reaction rates when the mechanism of the reaction does not significantly change. It also describes single reaction rates and does not necessarily describe the temperature dependence of a series of reactions that have different individual temperature dependences. Furthermore, the Arrhenius expression does not describe reaction rates where the direction of the equilibrium changes, for example, phase change, where the favored form is temperature-dependent. For all of these reasons, it is necessary to examine the effect of temperature change in rather more detail.

THE INFLUENCE OF TEMPERATURE CHANGE

As temperature is lowered, many processes will slow. In tissue systems, there may be changes in membrane and organelle properties that produce altered metabolic pathways. Should this happen, the mere act of chilling can produce product quality loss, known as chilling damage (Lyons 1973; Wilson, 1987). If chilling damage is not a problem, refrigeration close to the freezing point can lead to a significant extension of shelf life. Freezing and the freezing point are the next source of complications to the simplified "lower temperatures give longer storage" picture. Why should this be? Freezing implies phase change. The aqueous component of the tissue separates into at least two phases, one of which is ice. Since some of the water has separated out as ice, the remaining liquid phase has to have increased solute concentrations. The presence of ice and the increase in solute concentration can have significant effects upon the state of the tissue that is being frozen (Brown, 1979; Reid, 1983). Let us therefore follow a freezing process in some detail, from this particular viewpoint.

THE FREEZING PROFILE

In order to freeze, heat must be removed from the product. Figure 7.1 shows a typical freezing profile for a point close to the surface of a product. In region A, the temperature is falling, but still above the freezing point. At the surface, as cooling progresses, the temperature will reach the freezing point. Due to difficulty in seeding ice, freezing does not immediately initiate. The temperature continues to fall. At some point, seeding (or nucleation) initiates freezing, and the temperature rises to close to the freezing point. This is region B in the plot. Closer to the center of the product, this undercooled region is not seen, and freezing initiates at the freezing point. As heat continues to be removed, the temperature now falls more slowly. The reason for the slower fall, given that the rate of heat removal is unchanged, is that heat is released by the phase change from

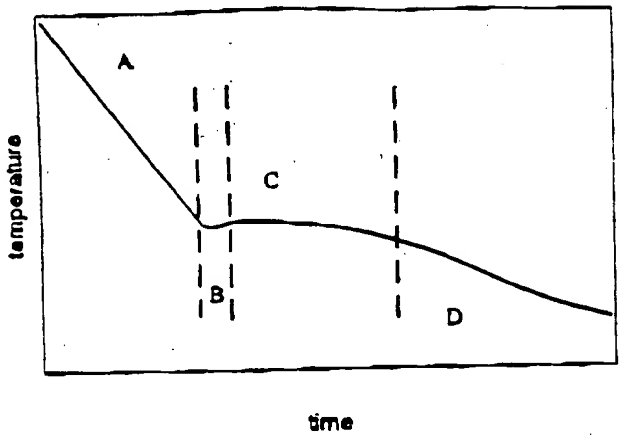

Figure 7.1 Schematic cooling curve. See text for an explanation of segments.

water to ice. This heat, termed latent heat, is additional to the sensible heat loss that accompanies temperature change. This region of slower temperature change due to the heat release of ice formation is region C in the plot. As the process continues, the rate of ice formation decreases, the contribution of latent heat decreases, and the temperature begins to fall more rapidly. This is region D. Many workers, e.g., Persson and Lohndahl (1993), have labelled these regions as follows: Region A–prefreezing, regions B and C–freezing, region D–reduction to storage temperature.

THE FREEZING PROCESS DESCRIBED BY PHASE DIAGRAM

Another view of this freezing process can be obtained through the use of a simplified phase diagram. If we assume that in the initial freezing process only ice will separate out, we can utilize the schematic binary phase diagram of Figure 7.2 to help describe the process. The product composition is assumed to be represented by X. Initially, as the product is cooled, the composition stays unchanged. Segment PQ represents this initial cooling and corresponds to region A of Figure 7.1. Region B, the period of undercooling prior to the initiation of crystallization, is represented by the short section QR, which lies below the liquidus curve (the liquidus curve shows the concentration dependence of the melting point, indicating the one temperature at which a solution of a *given* composition and ice can coexist in equilibrium). When freezing initiates, the system separates into two phases: (a) ice, represented by the left axis (i.e., 100% water) and (b) a more concentrated solution, where the concentration is defined by the liquidus coordinate for that temperature. This is represented by the short curve from R to Q′, where Q′ is a point on the liquidus curve, QT. The

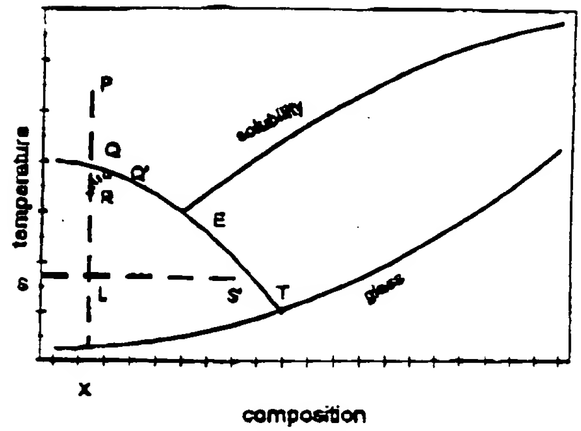

Figure 7.2 Schematic phase diagram for a binary system. See text for an explanation of labels.

curved segment of the liquidus from Q′ to S illustrates the change in concentration of the non-ice matrix as we move through region C. The segment of the liquidus from S to T is region D, where the rate of ice formation has reduced. A useful property of a phase diagram of this type is that it allows for the estimation of the amount of ice at any temperature. For example, the line S′S at temperature T_1 crosses the line PX at point L. For our system of overall composition X, at temperature T_1, the ratio of the amount of ice to the amount of solution of composition represented by point S is simply S/LS′. The overall composition is still X. This diagram shows that, as the temperature decreases, the amount of ice increases, and the composition of the unfrozen phase increases. At some temperature and liquid phase composition, a second phase may start to separate out, yielding what is termed a eutectic mix. This would happen at point E, where the solubility curve of the crystallized material intersects the liquidus. Solute crystallization does not always take place, due to kinetic constraints (Franks, 1982). Should this prove to be the case, the unfrozen phase continues to cool until it crosses a kinetic threshold and becomes effectively solid (in a glassy state). Since this glassy phase is produced by the freeze-concentration process just described, it is often referred to as the glassy state of the maximally freeze-concentrated matrix. The temperature of transformation to this glassy matrix can be measured and has some significance for frozen storage stability, since it has been suggested that, once the unfrozen matrix enters the glassy state, the rate of change in storage will significantly reduce (Levine and Slade, 1989; Slade and Levine, 1991). The relevance of this to produce freezing is discussed briefly in Reid (1990). Current research in my laboratory seeks to establish this critical temperature for many frozen products, including fruits.

FREEZING IN TISSUE SYSTEMS

Up to this point, the discussion has been of freezing in a uniform system. Consider now the freezing process as it might occur in plant tissue. In addition to the complexities introduced by the formation of ice as temperature is lowered, an additional complexity is introduced. In plant tissues there are cells, with cell walls. In other words, there are at least two distinct environmental situations. There are cell interiors, which are individual, separate entities, and there are the extracellular spaces in between, which exist in a connected network. This additional state, "inside or outside" interacts with the phase state of the aqueous system. The interaction depends upon the properties of the cell wall boundaries. If the cell wall and cell membranes are intact and in functional form, they provide a barrier that is permeable only to certain small molecules, including water. If this barrier is somehow damaged, molecular movements through the barrier become much easier. Damage to the barrier can result from a variety of causes. In processing, the most common cause of damage is heat treatment, such as might be applied in blanching. If the barrier is intact, it will allow for the process of osmosis (or selective water transfer) to occur between the cell contents and the external environment of the cell. This becomes of particular relevance if the external environment is changing due to ice formation. A damaged barrier does not support osmotic processes. The process of osmosis is the passage of solvent through a barrier permeable to solvent but not to solute, in such an amount as to tend to equalize the concentration of the solutions on either side of the barrier.

Freezing in the Presence of Cells

Let us look at the freezing process again, taking into account the presence of cells. The first cooling, A, is the same. Once we reach regions B and C, the presence of cells changes the detailed picture. Ice forms external to cells, in general, since, even if some ice growth initiates within a cell, it can only reach another cell by growing into the external matrix between cells. If ice is in the external matrix and the cell wall barrier is intact and effective, ice does not penetrate into the cell. Since water can permeate through the membrane, an osmotic process will occur. Water will leave the cell, forming additional extracellular ice and, at the same time, increasing the concentration of the internal cell contents in the direction of the concentration of the external unfrozen matrix. As the temperature falls and the external unfrozen matrix concentration increases as described by the liquidus line in the phase diagram, the concentration of the internal medium will tend to increase in the same manner. The maximum rate at which water can leave the cell is important to the effectiveness of this process, as this governs the maximum rate at which the concentration of the internal

medium can increase. If water cannot be exported sufficiently rapidly, the internal contents will be more dilute than required for equilibrium (described by a coordinate point below the liquidus). The contents are therefore undercooled by an amount described by the difference between the liquidus temperature coordinate for the actual internal solution composition and the actual internal temperature. If the undercooling exceeds a threshold value characteristic of the particular tissue, internal seeding of ice and consequent ice growth may occur. Once ice forms within the cell, the concentrations of the internal and external unfrozen matrices match, and there is no longer an osmotic driving force for water transfer. The system-dependent variation in cross-barrier water transport rates of the osmotic process accounts, in part, for the differences between fast freezing and slow freezing. In fast freezing, there is insufficient time to remove the water from the cell through osmosis. The cell contents undercool and seed, and ice forms within the cell. In slow freezing, there is enough time to remove the appropriate amount of water from the cell. The concentration of the cell contents increases sufficiently rapidly to prevent the cell contents from being significantly undercooled. Ice does not form within the cell. Note that, if any change should occur on freezing that would prevent this water from returning to the cell on thawing, then the water will become a source of drip loss. It may be for this reason that drip loss is often more marked in slowly frozen fruits. Fast freezing and slow freezing are therefore operational definitions, and the threshold freezing rate separating fast freezing from slow freezing will be system-dependent.

THE FREEZING PROCESS AND FREEZING DAMAGE

Osmotic Damage

When heat is removed rapidly, ice forms rapidly. These ice crystals tend to be small. Since the ice grows rapidly, the concentration of the external unfrozen matrix rises rapidly. Osmotic transfer of water is limited. The cells freeze internally. Little water translocates. In slow cooling, the ice forms slowly, external to the cells. There is sufficient time for a large amount of osmotic transfer of water from the cells. This results in cell shrinkage, which can damage the membranes (Meryman, 1971; Steponkus, 1984). A considerable amount of water translocates. Due to cell wall damage consequent upon the freezing process, this water does not return to the cells on thawing but, rather, becomes drip loss.

Solute-Induced Damage

In addition to this cell shrinkage mechanism for damage, primarily linked to the extensive cellular dehydration accompanying slow freezing,

there are other mechanisms of damage. The high-solute concentrations of the unfrozen matrix, in particular the high salt concentrations, can cause damage to many polymeric cell components and may kill the cell (Mazur, 1977). To prevent this, some form of solution-based protection might be needed (Meryman et al., 1977). A typical method for reducing salt concentration-induced damage is to add sugars to the aqueous phase that is undergoing "freeze-concentration." Note that these sugars must actually be incorporated into the solution that is freezing. It is not enough to add the sugar to the overall system. The concentration effect is present whether freezing is fast or slow.

Structural Damage

In fast freezing, additional to the concentration effect, the formation of ice within the cell may cause damage to the delicate organelle and membrane structures of the cell. As one consequence, enzyme systems may be dislocated. This may result in uncontrolled enzyme action, leading to a variety of effects, including the production of off-flavors. Prevention of such enzyme-mediated damage can be achieved by utilizing blanching, a prefreezing heat treatment that denatures the enzymes and, hence, terminates their catalytic activity; however, it has to be remembered that blanching, since it is a heat treatment, will influence the semipermeable properties of the cell membrane and also destroy cell turgor. Cell turgor is an important component of the eating quality of many fruits. It is produced by the internal pressure of the cell contents. Lack of turgor is perceived as softness and lack of crispness and juiciness. Where turgor is an important product characteristic, blanching may not be an acceptable procedure, and other steps may be necessary to control enzymically initiated degradative processes. Blanching is not the only cause of reduced turgor. If cells become leaky or lose some of their contents, turgor is reduced or destroyed, and the texture of the fruit becomes much softer (Brown, 1977; Mohr, 1971). A loss of turgor caused by freezing is particularly evident in fruits such as strawberry (Szczesniak and Smith, 1969). Loss of turgor due to processing procedures is of most relevance to fruits that are customarily eaten raw, rather than fruits that are customarily cooked. Cooking, a more severe thermal treatment than blanching, destroys turgor so that the retention of turgor through earlier processing procedures is not necessary.

Familiarity with the molecular picture of the freezing process is necessary if we are to appreciate the sources of freezing damage, which result in a reduction in consumer-perceived quality in comparison to the fresh raw product. Through an awareness of the mechanisms of damage, it is possible to identify whether careful design and control of the freezing processes applied to the product might avoid or minimize some of the quality degradation.

INDUSTRIAL FREEZING METHODS

FREEZERS

It is now appropriate to consider the industrial freezing processes are applied to fruit products. In order to remove heat, the product mus brought into contact with a cold medium. This can be cold air, in a b freezer, cryogenic liquids or gases in a cryogenic freezer, or cold surfa in a plate freezer. The heat transfer mechanism in cold air is thro convection. This can be assisted by blowing the air over the prod Cryogenic gases are similarly blown past the product and, due to t lower temperature, result in more rapid heat transfer. Cryogenic liqu have a higher thermal density and remove heat more rapidly still, du an improved heat transfer capability. Heat transfer to a cold surface te to be by conduction, and the effectiveness depends on the quality of thermal contact. Reid (1991) discusses briefly the many types of comm cial freezers that exist and that can be utilized in the freezing of p tissues. This discussion includes consideration of the methods by wh large quantities of the product can be exposed to freezing conditions, lizing both batch and continuous methods. A more extensive discussio freezers is given by Persson and Londahl (1993). The choice of appropr freezer is, in part, governed by the product size and, in part, governe the required freezing rate. Small fruits, which need to be frozen rapi might be frozen in a low-temperature, high air velocity blast freezer o a cryogenic freezer to produce an individually quick frozen (IQF) prod Fruits packed in large cans or drums, on the other hand, will not fre quickly, due to heat transfer limitations and so are usually frozen in a c room with a high-capacity cooling unit and reasonable air circulati Note that it is poor practice to freeze such product in a cold storage ro A separate room should be set aside for product freezing. Retail packs approximately rectangular brick shape, are often frozen in plate (i.e., c duction) freezers. This method is reasonably successful, provided that package is well filled. Air spaces within the package will slow down h removal significantly.

PREFREEZING HANDLING AND PREPARATION

Prior to entering the freezer, the fruit must be prepared appropriat Methods of preparation are specific to the individual fruit, but there some common factors that can be identified. The preparation begin harvest. Poor handling at this stage can irreversibly degrade final pro quality. Methods of harvesting are discussed in several major textbo for example, Woodroof and Luh (1975) and Tressler et al. (1968). Acc

able harvesting methods are designed to minimize mechanical damage to the fruit. After harvest, cleaning will be required. The method of cleaning is fruit specific. Sorting and trimming will also be required to remove undesirable materials. Many fruits are peeled, or they may be sliced. A variety of specially designed pieces of equipment exists for these tasks. It is often necessary to remove field heat rapidly prior to these process steps, especially for highly perishable fruits, if unacceptable damage is to be avoided. The processor has the responsibility of delivering the fruit to the freezing equipment at as high a quality level as is practical.

FREEZING METHODS FOR SPECIFIC FRUITS

In this section, details of the processing procedures for selected fruits are given. The information summarized in this section comes from a variety of sources, including Woodroof and Luh (1975), Tressler et al. (1968), and TRRF (1993).

APPLE

Not all varieties of apple give an acceptable product when frozen, whether the end use is for the bakery trade or for other purposes; however, some cultivars of apple are suitable for freezing. These are sorted, washed, peeled, cored, and sliced. The sliced fruit is treated to minimize enzymatic browning. This can be achieved by application of antioxidant solutions, including some proprietary treatments. One common treatment is salt brining, soaking slices in a 1% salt solution in order to remove intercellular air. Ascorbic acid solutions can also be used, but these tend to be expensive. A surface blanch, using steam or boiling water, can also be employed, though it results in a softened slice, which may not be suited to some uses. The treated slices in a ratio of five parts fruit to one part dry sugar are frozen in large 30- to 50-lb containers in a blast freezer below $-10°F$. Some apples may be frozen using a dehydrofreezing process, where about 50% of the water is removed from the apple slices by standard drying equipment prior to freezing the slices.

APRICOT

Though some apricots are frozen whole for later processing, the major proportion of apricots are usually frozen as peeled apricot halves. This enhances the tendency for browning and, therefore, requires steps to be taken to minimize browning. The apricots are peeled, halved and pitted, dipped in ascorbic acid solution to minimize browning, or blanched for a short time to inactivate the enzymes. The halves are packed in sugar or sugar

syrup prior to freezing at a 3:1 or 4:1 ratio of fruit to sugar. Air blast freezers are adequate. It is best to freeze the apricots on trays or on a belt prior to packing into barrels or 30-lb containers. This helps minimize discoloration. Storage should be below 0°F. For good retention of ascorbic acid, storage should be at −20°F.

AVOCADO

Avocados present a challenge to the commercial freezer due to their high oil content, which readily becomes rancid, and also because of a very active oxidative browning system. Pureed avocado is a successful product. Preservation life is enhanced by lowering the pH of the puree to below 4.5 through the addition of lemon juice, lime juice, and salt. Packaging under nitrogen also enhances shelf life. Vacuum packaging has also been employed. Any reasonably rapid freezing method can be employed. Storage should be around 0°F for a reasonable shelf life.

BERRIES

Many varieties of berry are frozen. Berries can be frozen in syrup or as individual berries. As individual berries, they may be tray frozen or IQF frozen on a belt in an air blast or cryogenic freezer. Individually frozen berries will be discussed after discussing bulk methods for freezing for retail or the processing trade.

Red raspberries for retail are packed in an approximately 50% syrup, in the proportion of six parts berry to four parts syrup, and 10- and 16-oz containers are used. Any reasonably rapid freezing method may be employed.

Black raspberries are used for further processing and are packed in 30-lb containers or larger. In order to successfully freeze berries in a large container, the following procedures have been shown to be necessary (*TRRF Commodity Storage Handbook*, 1993):

(1) The temperature of the fruit should not exceed 60°F at the time of filling.
(2) The containers should be moved to the freezer as quickly as possible.
(3) The temperature on entering the freezer should be below 70°F.
(4) Freezer conditions (air temperature < −15°F and airflow velocity high) should allow for the center of the container to reach a temperature of 32°F or less within 48 hr.
(5) Freezing should be continued until the center temperature is 0°F. This should take no more than four to five days.
(6) Storage should be below 0°F.

Reasons for these recommendations were discussed previously in the text.

Blackberries, boysenberries, loganberries, and so forth, are frozen utilizing the same procedures as have been described for raspberries. Blueberries are frozen in 20-lb containers, with steps being taken to minimize or eliminate air in the package.

CHERRY

The major portion of cherries frozen are tart cherries, though some sweet cherries are also frozen. The procedures for freezing are essentially the same. Tart cherries are harvested when bright red, sweet cherries when mature. The cherries are held and transported in ice-cold water, which reduces losses due to crushing and bruising and makes the fruit firmer for pitting. Fruits are size graded, pitted, packed with sugar in large cans, and frozen in a blast freezer.

COCONUT

Shredded coconut can be frozen without any particular preparation. The rate of freezing is not critical so long as cooling is sufficiently rapid to minimize microbiological contamination. Storage, in large containers, is at 0°F.

CRANBERRY

Cranberries are frozen at 0°F using conventional techniques. The majority of the frozen crop is used for processing.

DATES

Fresh dates may be frozen. The use of a good moisture-proof and vapor-proof wrapping is recommended to prevent moisture loss during freezing or storage.

FIGS

Figs can be frozen as whole fruit in heavy syrup or as sliced fruit as four parts fruit to one part water. Standard freezing methods are employed. Storage temperatures should be below 0°F.

MANGO

Mango is frozen as slices in syrup. The syrup contains ascorbic acid to inhibit polyphenol oxidase-induced browning. In addition, mango puree is a significant frozen product. Purees can be single or double strength. Stor-

age should be at or below 0°F. Browning can be a significant problem higher storage temperatures due to nonenzymic browning.

MELON

Melon is frozen when the texture is firm enough to allow for cutting cubes or balls that retain their integrity. If too ripe, a very mushy produ will result, since fully thawed melon loses considerable texture. Melon usually frozen in syrup.

PAPAYA

Papaya puree is prepared from ripe papaya. Steamed fruit can be slice and crushed, and the pulp can be separated from the skin. The acidifie pulp is passed through a heat exchanger to inactivate enzymes before cool ing and freezing to −10°F.

PEACH

In general, freestone peaches are used for freezing. Yellow fleshed vari eties are preferred for better texture and lower susceptibility to oxidativ browning. Fruit for freezing is usually harvested while still firm and ther ripened under control. The peaches are pitted, peeled, and sliced prior t freezing. The usual pack is in syrup (one part syrup to five parts peach containing around 250 ppm ascorbic acid to help protect against browning Freezing is usually in packages; 32- to 40-lb packs are common. Large barrels are also available. Freezing methods are, in general, as describe for other bulk frozen fruit products. Some IQF slices are frozen for specia markets. Storage should be at temperatures below 0°F if extended shel life is required. The limiting change is the browning.

PINEAPPLE

Pineapple for freezing is prepared in the same way as pineapple for canning. Rectangular chunks are filled in syrup into cans or bulk containers and frozen. The cans are frozen in a blast tunnel, the bulk containers in a blast freezer. The Smooth Cayenne variety should be frozen. The Red Spanish variety has a tendency to develop off-flavors on freezing.

PLUM

A small volume of purple plums and prunes are frozen for institutional markets and for further processing. The fruit is halved, pitted, and packed

in syrup in barrels. Freezing is by standard methods. Storage is at or below 0°F.

RHUBARB

Rhubarb freezes easily and requires no special treatment, though a short blanch can extend the storage life significantly. Rhubarb can be frozen with or without sugar. Stalks are trimmed to fit the package. Storage life at 0°F is at least six months.

STRAWBERRY

Not all varieties of strawberry freeze well. The selection of varieties for freezing should be made in conjunction with agricultural advisors familiar with the production state. Strawberries are frozen in several forms, depending on the final end use. Most strawberries are frozen as a raw material for use in further processing. Depending on the final product, different freezing procedures might be appropriate. For use in jam manufacture or ice cream, strawberries are packed in syrup and frozen. This can be in 30-lb tins or 50-gal barrels. The strawberries may be sliced and sugared for this process. The procedures described under berries are appropriate. Since strawberries are even more fragile than many other berries, it is recommended that the critical times be shorter. For example, a core temperature of 15°F should be reached in no more than 24–36 hr. Storage should be at 0°F or below for a reasonable shelf life. Flavor and color are lost rapidly if the storage temperature is too high.

IQF methods are used to produce frozen whole strawberries for both institutional and retail trade. Freezing utilizes air blast, liquid nitrogen, or carbon dioxide belt freezers. Storage of IQF fruit should be at a stable, low temperature to prevent clumping of the berries (due to moisture migration) and loss of the IQF character.

TOMATO

Whole tomatoes are not an item of frozen commerce. They lose turgor and, hence, texture on freezing and are no longer suited to the uses common for fresh tomatoes. Chopped or pureed whole tomatoes can be frozen and stored for six to nine months at 0°F for use in further processing. Other tomato products such as purees, sauces, and pastes can readily be frozen. They are commonly employed as ingredients in other frozen products. Freezing provides an advantage of color stability compared to other storage methods.

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